to 50-ft. thick) is removed by a powerful mechanical excavator and the more persistent is loosened by hand picking and cranes. The top and skull caps are loosened by blasting.

After the roach bed has been cleared, the quarrymen begin to remove the stone from each stratum. This operation is facilitated by the presence of natural vertical joints which exist parallel to and at right angles to the face of the bed, and also the existence of horizontal beds of shells which separate the layers of stone. Commencing from one of the right-angled vertical joints, a number of strong metal wedges (see C, Fig. 19) are inserted at intervals along a shell bed and gradually and evenly hammered in until the stone is split horizontally and the slab becomes detached; if necessary, this slab is divided vertically by wedging (see B, Fig. 19). Each block is now lifted clear of the stratum by means of a crane, roughly squared up by the use of a large hammer and loaded into a truck for transit to the works for final dressing.

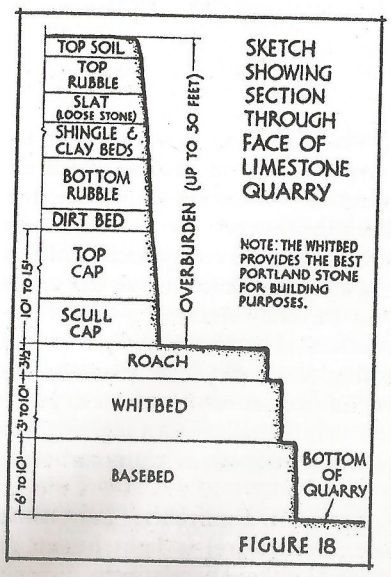

FIGURE 18

Blasting has sometimes to be resorted to in sandstone quarries because of the hardness of the stone. Briefly, a series of deep holes (about 1-in. in diameter) are formed by a drilling machine at the required distance from and parallel to the face of the quarry; a small charge of black gunpowder and a fuse are placed in each hole and the hole is partially packed or tamped with sand; the fuses are connected to a battery and the charges fired; this explosion is sufficient to shake the mass of stone; the holes are now cleared of tamping and the second or main charges inserted and again fired simultaneously. This removes a large bulk of stone which is only slightly shattered because of the use of two blasts. The large blocks are then divided by splitting and wedging (see p. 35) and roughly squared up for dispatch to the works for subsequent dressing. The average size of the blocks when dispatched is from 25 to 30-cub. ft., although much larger blocks are obtainable when required.

There is very little overburden in many of the sandstone quarries. Thus in the Stancliffe stone (see p. 33) quarry the overburden does not exceed 6-ft. in depth; the depth of the present working face is 160-ft. although some of the best stone is obtained at a depth of from 8 to 10-ft.

Blasting is not necessary in those sandstone quarries where the beds are thin and frequently divided by natural fissures. Thus, in quarries from which much of the " walling stone " used for " Rubble Work " (see p. 39) is obtained, the thickness of the beds of good building stone varies from a minimum of 2-in. to a maximum of 4-ft., and comparatively little labour is required for the removal of the stone.

PREPARATION

Whereas formerly the whole of the labours involved in dressing building stones after removal from the quarry were done by hand, by the " banker mason," most of this work is now executed by machinery.

> Speedy erection of buildings is generally a necessary requirement, and this would not be possible if machines were not available for the purpose of converting the rough blocks into dressed or *wrought* stone; indeed, it is not uncommon in connection with large contracts, for the machines to be worked continuously day and night, in order that the rate of delivery of the dressed stone shall comply with the strictly limited scheduled time.

Although most of the work involved in dressing stone may be done by machinery, there are certain *surface finishes* which can only be worked by hand. These finishes are described on pp. 35-38.

MACHINE DRESSING.—The machines used for this purpose include the frame saw, circular saw, rubbing bed, and planing and moulding machines.

The rough block of stone from the quarry is first taken to the *frame saw* which converts it into a number of slabs such as are shown at A, Fig. 19, the thickness of the slabs varying in accordance with requirements.

> The frame saw is a machine consisting of a rectangular horizontal frame, suspended by rods, which holds several (sometimes six) plain or corrugated steel blades, each blade being from 3 to 6-in. deep, $\frac{5}{16}$-in. thick, and from 6 to 15-ft. long. These blades are parallel to and at adjustable distances from each other. Electric or other power is supplied to give the frame a short backward and forward motion at a rate of from 150 to 180 strokes per minute.
>
> The rough stone is placed on a movable table which is brought under the frame. After the blades have been set to the required distance apart the frame is lowered and set in motion. The frame, being under constant pressure, causes the blades to descend as they cut the stone during the to-and-fro movement. During this process, water is supplied immediately over the cuts through nozzles of a water feed which swings backwards and forwards. At the same time an abrasive agent such as sharp sand, chilled shot (small steel balls) or carborundum is applied along the length of the cut, and thereby assist in the cutting action of the blades. Sand should be the abrasive used for the sawing of Portland stone as steel shot tends to discolour the stone on account of rust.
>
> The frame is raised after the sawing operation has been completed, the table is pushed clear of the frame, and the slabs are unloaded and taken to another machine for the next dressing operation.

The frame saw is the best machine for cutting hard stone. The speed of cutting depends upon the number of cuts and the hardness of the stone. Hard sandstone may be cut at the rate of 6-in. (thickness) per hour and Portland stone may be cut at the rate of 12-in. per hour.

Assuming that these slabs of stone are required for general walling, each is now conveyed to the *circular saw* for the cutting of the remaining faces. There are two types of this machine, *i.e.*, the *diamond saw* and the *carborundum saw*.